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ABSTRACT

This paper, which updates and expands on the first edition (1981), begins by presenting a definition of instructional development (ID) and a discussion of its origins. A taxonomy for classifying ID models is then suggested, and it is noted that most ID models have been subjected to only a limited degree of testing. The 12 ID models that are reviewed are divided into the three categories specified by the taxonomy as they focus on the classroom, the product, and the systems. Specific models are described and discussed in each of these categories: (1) classroom--Gerlach and Ely; Heinich, Molenda, and Russell; Dick and Reiser; and Kemp; (2) product--Van Patten; Leshin, Pollock, and Reigeluth; and Bergman and Moore; and (3) systems--IDI (Instructional Development Institute); ISPISD (Inservices Procedures for Instructional Systems Development); Dick and Carey; Seels and Glasgow; and Diamond. The taxonomy and 11 of the 12 models are depicted in 12 figures. A guide to searching ERIC for ID models is provided in the Foreword, and the annotated ERIC bibliography lists 19 journal articles and 14 documents. Instructions for obtaining copies of ERIC documents and journal articles are included. (30 references) (DB)

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SURVEY OF INSTRUCTIONAL DEVELOPMENT MODELS

by Kent L. Gustafson

SECOND EDITION

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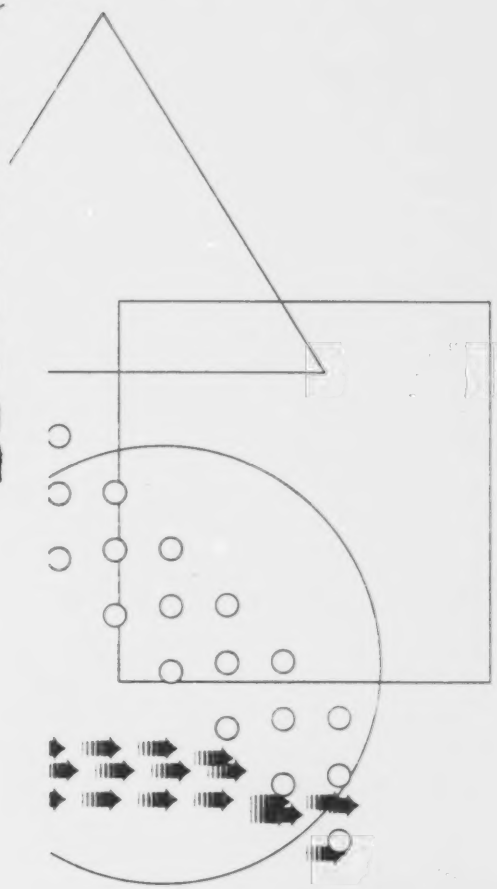

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Foreword

Although much has been written about instructional development in recent years, most scholars tend to agree that instructional development, regardless of the form a model may take, is a process of systematically designing, sequencing, implementing, evaluating, and constantly monitoring instruction with the intent of improving its quality and effectiveness, and thereby enhancing learning. In the same vein, instructional development has also been often referred to as the *systems approach*. And, not surprisingly, one can cite many references in which the systems approach has been defined using the same terms employed to define instructional development.

Confusion also proliferates in the attempt to define instructional technology and educational technology. One does not have to read many journals in the field to find the terms instructional technology, educational technology, systems approach, and instructional development used interchangeably.

Nevertheless, the conviction of most ISD professionals is that instructional development is a team-oriented process aimed at product development; and the product is to be used by people. As Gustafson said in 1971: "The most important element of instructional development is people. . . people are its energy, its insight, its product and its consumer and to engage in instructional development is to change people."

Finding Models in ERIC

In May of 1990, the ERIC Clearinghouse on Information Resources conducted an ERIC search which included -

publication dates ranging from 1980 to March of 1990 with the following search terms:

(Instructional Development/major OR Instructional Design/major)
AND
(Models/major OR Theories/major)

This search resulted in 161 citations. As an aside, they were originally asked to conduct a search using the following search terms, but they resulted in far too many citations:

(Instructional-Design OR Curriculum-Design OR Instructional-Development OR Instructional-Improvement OR Educational-Technology OR Curriculum-Development OR Educational-Strategies)
AND
(Models- OR Research-Design OR Systems-Approach OR Theories-)

Of the original 161 citations, 33 titles (19 periodicals and 14 ERIC documents) were found to be highly relevant, and so are included in this annotated bibliography.

It is interesting to note the publication dates of these 33 periodicals and ERIC documents. Four are dated 1980 or earlier, 17 are dated between 1981 and 1985, and only 11 are dated between 1986 and 1990. This would seem to indicate that the number of publications about ID models—either describing a new one or augmenting an old—is either decreasing or leveling off.

Regardless of age, the following annotated bibliography represents the documents entered in the ERIC database from 1980 to March 1990 that have a significant link to Instructional Development (models).

Gary C. Powell
with
Kent L. Gustafson
Athens, Georgia
April 1991

INTRODUCTION

The purpose of this ERIC synthesis paper is to update and expand on earlier publications by Twelker *et al.* (1972) and Gustafson (1981) on the topic of instructional development (ID) models. Since the first appearance of ID models in the sixties, there has been an ever increasing number appearing in the literature of both instructional technology and general education. This publication reviews some of the current ID models, presents a taxonomy for classifying them, and describes trends in their content and focus. A list of references and an annotated bibliography of selected ID models found in the ERIC database are also provided.

In preparing this survey it was necessary to select only a few models to describe in detail. This was difficult since there are literally hundreds in the literature within and outside of what might be considered the mainstream in instructional technology. Decision criteria included the historical significance of the model, its unique structure or perspective, and its general distribution. Obviously too, it was necessary to select models to match each of the categories in the classification taxonomy. Thus, many excellent models are not included in this survey. The decision was also made to exclude models that represent only part of the process, e.g., needs assessment, media selection, or evaluation. Those that were selected are believed to be representative of the literature and, among them, to contain all of the main concepts found in other models.

Definition of Instructional Development

One of the major problems plaguing the field is inconsistent use of terminology. The term instructional development is no exception. Although an attempt was made over a decade ago by a committee of professionals under the leadership of Dr. Kenneth Silber and the Association for Educational Communications and Technology to develop a standard set of definitions, they have not been widely adopted. It is their definition, however, that is used to structure this survey, although, as will be noted throughout the descriptions of models, they use a variety of other terms for essentially the same concepts and processes.

The AECT definition is as follows:

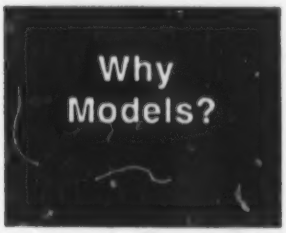
> Instructional development. A systematic approach to the design, production, evaluation, and utilization of complete systems of instruction, including all appropriate components and a management pattern for using them; instructional development is larger than instructional product development, which is concerned with only isolated products, and is larger than instructional design, which is only one phase of instructional development. (1977, p. 172)

As can be seen, this definition encompasses a wide array of activities, from the initial sensing of a concern that "something" ought to be done, to implementing and monitoring the instruction that has been developed on a long term basis. Consistent with the above definition, the term instructional *design* has a more limited meaning, usually associated with specifying the sequence of instructional topics and activities, the nature of interactive lesson elements, and motivational plans. However, in recent years the term instructional design has become increasingly used as the broader term to represent the entire process, while the term instructional development is used to describe what some have called production activities. If this trend continues, the title of any subsequent ERIC review paper might well be changed from instructional development to instructional design.

Another term that adds to the confusion is "system." The term system is used in at least three different ways, one of

which is equivalent with how we have chosen to use instructional development in this survey. When used to represent the broad array of activities we call instructional development, the term instructional systems development (ISD) is commonly employed. In essence, the model becomes a system for guiding the preparation of instruction to accomplish specific goals and objectives. However, the term system is also used by some authors to describe the *outcomes* or products in the development effort. From their perspective, the learners, environment, and its related management and support components together comprise an instructional system. Still a third, but less common use of the term system, is in the context of general systems theory (GST). Within this perspective, numerous general system theory concepts (e.g., open and closed systems, entropy, and interdependence) are applied to the instructional development process.

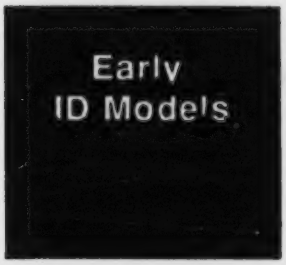
In some respects the profession finds itself in an *Alice in Wonderland* setting where any term means whatever the author wants it to mean. This situation is one of the reasons this author has found it desirable to create a taxonomy for classifying models. By carefully examining each one you can determine what activities their creators are describing and the goals and settings in which the activities are to occur. You are then in a position to understand what they are talking about even though the terminology is inconsistent.



Instructional developers and their models have often been compared to Linus and his blanket—you never see one without the other! While other professionals share this trait, developers have elevated it to new heights. In the physical and natural sciences, models serve a variety of purposes, including theory building and testing, description, prediction, and explanation. However, developers seem to have more limited purposes in mind. With apologies to the very few theorists in our field, ID practitioners typically use models primarily as: (1) communication devices with their clients and each other; (2) planning guides for management activities; or (3) prescriptive algorithms for decision making. While these

purposes can overlap, most models tend to focus on a single purpose.

This focus on a single purpose is understandable. If a model is to communicate with an unskilled client, it must be simple and devoid of professional jargon. On the other hand, to be a useful management tool, it should account for all of the major tasks to be performed. And, if it is to be prescriptive, it must contain extensive detail describing precisely how to perform specified tasks. Thus models vary widely in their purposes, the amount of detail provided, and the technical jargon they contain. No single model is useful for all settings and purposes, a point to be elaborated later in this paper. We now turn our attention to some of the early ID models and the origins of the ID process.



Of necessity, one must pick an arbitrary date from which to begin to trace the origins of the ID model building process. Otherwise one can make the case that the creators of the earliest recorded cave drawings and the scribes that produced papyrus scrolls represent the pioneers of systematic instruction. Similarly, many ideas and procedures commonly found in ID models (e.g., job analysis, measurable objectives, and performance testing) predate the period generally accepted as representing the beginnings of ID model building.

The specific term *instructional development*, defined as a systematic process for improving instruction, appears to have had its origin in a project conducted at Michigan State University from 1961 to 1965. Entitled *Instructional Systems Development: A Demonstration and Evaluation Project* (1967), this project directed by Dr. John Barson produced one of the early ID models. The setting for the model and its related project was higher education, with the goal of improving college courses. Barson's model was reviewed in the first ERIC paper by Twelker *et al.* (1972). The reader is also referred to the Barson project final report (ED 020 673) for more details. The Barson model is notable in that it is one of the few models ever subjected to evaluation. The Barson project also produced a set of heuristics for instructional developers, many of which continue to serve as general guides to developers in higher education.

Other early works by a number of authors also produced ID models, although they did not use the specific term *instructional development*. The programmed instruction movement also used a systematic process, but generally did not recognize the major contribution of the tryout and revision process to the successes it recorded. In the 1950s and 1960s one of the most influential model builders was L. C. Silvern (1965). His work with the military and aerospace industry resulted in an extremely complex and detailed model (with variations) that drew heavily on general systems theory. The model is not widely circulated today, but remains an excellent source document for those willing to wade through Silvern's sometimes obscure writing. Students of the ID process will readily see his influence on the content of contemporary models.

The model by Hamreus (1968), developed at the Teaching Research Division of the Oregon State System of Higher Education, is another classic. One of his significant contributions was to present the model in a "maxi" and a "mini" version. This "two-size" approach was based on the belief that there is a need for a simple model to communicate with clients and a more detailed operational version for those working on the project. Hamreus' model evolved into the Instructional Development Institute (IDI) model (1971). The latter model has received extremely wide distribution and is among the best known in the United States. In fact, the IDI model was recently reproduced and described by Seels and Glasgow (1990) in their book on the ID process. Since Hamreus' model was extensively reviewed in the Twelker paper, the reader is referred there for details. However, the IDI model, because of its wide circulation and notoriety, will be discussed in a later portion of this monograph.

In addition to the Twelker review, at least three other major reviews of ID models have been conducted and are worthy of study by developers. As early as 1972, Stamas reviewed 23 models by determining whether or not each included a list of model components that he felt were desirable. Originally part of a doctoral dissertation at Michigan State University, this study (Stamas, 1972) was also reproduced as an occasional paper by the Division of Instructional Development of the Association for Educational Communications and Technology. In 1980, Andrews and Good-

son reviewed 40 models in the *Journal of Instructional Development*. Like Stamas they developed a matrix of ID elements and analyzed the models using those elements. They also attempted to trace a logical progression or evolution of later models from earlier ones, but were unable to detect any pattern. Their findings add weight to the view that the literature on models is circular rather than cumulative, with little of substance being added in the last few years. More recently, Salisbury (1990) reviewed a number of ID models from major textbooks in the field to assess the degree to which they contained specific references to a range of general systems theory concepts. He concluded that most models contained few specific references to those general systems concepts contained in his matrix.

A Taxonomy of ID Models

A scholarly wit once said that only two things are certain: death and taxonomies. This survey is no exception on the latter point. The present taxonomy is presented as having two benefits. First, the author has found that creating a taxonomy is an excellent means of reducing an otherwise unwieldy body of ID model literature into a manageable package. The literature contains dozens of ID models, but as will be discussed, most are simply variations on one of three basic structures. The taxonomy provides a vehicle for examining the assumptions and conditions associated with any ID model and places it in a scheme for easy understanding. Second, practicing developers can use the taxonomy to assist in analyzing the type of project on which they are about to embark. Then it is possible to select a model for adaptation to the specific situation. The approach helps to eliminate the "I have a model, now what's your problem" syndrome by better matching a model to the situation.

The proposed taxonomy divides the world of ID models into three categories: (1) classroom focus; (2) product focus; and (3) systems focus. The reader is cautioned, however, that like most taxonomies in the social sciences, the categories are a little fuzzy around the edges and not mutually exclusive. In fact, some models can exist as subsets of others, so no absolute hierarchy should be inferred.

The first category of ID models has a **classroom focus**. The models assume that there is already a teacher, some students, a curriculum, and a facility. The goal of the teacher is to do a better job of instruction within these constraints. The development situation often occurs when a teacher wants to improve his/her teaching. The teacher is frequently not part of a team and improvement will be limited to his/her own classroom, and only for as long as he/she chooses to use whatever results. Emphasis is usually placed on selecting and adapting existing materials and instructional strategies rather than developing them "from scratch."

A **product focus** is different from a classroom focus in that its goal is production of one or more specific instructional products. It usually assumes that development of the product is a given. Further, the product's objectives may be already determined. The goal is to prepare an effective and efficient product as quickly as possible. The product is usually expected to produce replicable results with an audience possessing specified characteristics. Product models are common in business settings where decisions on whether or not development should be done are made by someone other than the developers. Often, but not always, this decision is made in the absence of objective data. Proprietary and off-the-shelf courses are also examples of products that may have been developed using a product focused model.

A **systems focus** is somewhat different from a product focus, but the latter in some cases may become a subset of the former. The systems focus has as its goal the development of instructional output, which itself is considered to be a system. The output of the development effort may include materials, equipment, a management plan, and perhaps an instructor training package. This "system" can then be implemented or disseminated to target locations. The systems focus usually demands extensive analysis of: (1) the use environment, (2) characteristics of the task, and (c) whether or not development should even take place. It often employs a problem solving approach requiring data collection to determine the precise nature of the problem.

A matrix comparing the three classes of models on selected attributes is presented in Figure 1. In reviewing this figure, keep in mind the caveats that the taxonomy is not "pure" in

Selected Characteristics

FOCUS OF MODELS	Typical Outputs	Resources Committed to Dev. Process	Team or Individual Dev.	Emphasis on Dev. or Select Materials	Amount Front-End Analysis/Needs Assessment	Amount Tryout and Revision	Distribution/ Dissemination
Classroom Orientation	Hour of Instruction	Very Low	Ind.	Select	None to Low	Low to Med.	None
Product Orientation	Self Instructional Package	High	Ind. or Team	Dev. or Select	Low or Med.	Very High	High
Systems Orientation	School, College, or Military Course(s)	High	Team	Dev.	Very High	Med. to High	Med. to High

Figure 1. A matrix of types of models and selected characteristics.

a scientific sense, and that many models can be and have been used in a variety of instructional settings.

Figure 1 portrays a matrix of selected characteristics that often differ among the three classes of models. For example, classroom oriented models typically focus on creating one or a few hours of instruction, whereas product models often focus on producing self-instructional packages, and system models result in entire courses or curricula. The number of resources available is usually quite different, ranging from very low for classroom oriented efforts to very high for system oriented projects. Teams are more commonly employed for developing products and systems, while classroom teachers often have to work on their own or with minimal assistance. The degree to which materials are selected or developed varies, with classroom teachers often having little choice but to select, whereas product and system developers usually create original materials. Similarly, individual teachers usually are not able to conduct an extensive front-end analysis, but system developers consider that step essential as an early step in the process. The amount of tryout and revision usually varies from none by classroom teachers to extensive for product and system developers. And lastly, classroom teachers rarely distribute their instructional lessons whereas products and systems are specifically designed for this purpose.

Keeping these characteristics in mind when reviewing models will help you to identify their major assumptions, which are often not described by their creators. Applying these characteristics to your analysis will also help you to place any model in one of the three classes presented in this taxonomy.

CLASSROOM ID MODELS

Assumptions

Classroom ID models are primarily of interest to professional teachers who accept as a given that their role is to teach and that students require some form of instruction. Users include elementary and secondary school teachers, community college and vocational school instructors, and university faculty. Some training programs in business and industry also assume this classroom orientation, but the systems focus is becoming more common in such settings.

As indicated above, there exist a wide variety of classroom settings. Most teachers assume (with real justification) that students will be assigned to or will enroll in their classes, and that there will be "n" number of class meetings, each of "t" length. The teacher's role is to decide on appropriate content, plan instructional strategies, identify appropriate media and strategies, deliver the instruction, and evaluate learners. Due to the on-going nature of the instruction, which is often accompanied by a heavy teaching load, there is little time for developing new materials. Also, funds and time for development are usually limited. Hence their need is to identify existing resources for adaptation to existing conditions, rather than engaging in original development. Also, since many elementary and secondary teachers teach any topic only once a year, they have less concern for the rigorous formative evaluation associated with courses and workshops that are offered on a repetitive basis.

Teaching personnel usually view any ID model as a general road map to follow. Typically only a few functions are outlined in the model, and it simply provides a guide to the

teacher. It should be noted that although there are a number of classroom oriented ID models, they are not widely known to or adopted by teachers. The developer who works with teachers within the givens and assumptions described above would do well to employ any ID model with caution since the teachers are unlikely to be familiar with the concepts or processes of systematic design. Teachers may also view the process as mechanistic and resulting in dehumanized instruction. However the models discussed below have been found to be acceptable to and readily understandable by at least some teachers and represent a class of models with which all developers should be familiar.

Four models have been selected to represent the variety of ID models most applicable in the classroom environment. The respective authors are: (1) Gerlach and Ely, (2) Heinich, Molenda, and Russell, (3) Dick and Reiser, and (4) Kemp.

The Gerlach and Ely Model

The entry point of the Gerlach and Ely (1980) model (see Figure 2) calls for identifying **content** and specifying **objectives** as simultaneous, interactive activities. While Gerlach and Ely clearly prefer the approach of specifying objectives as a "first task," they recognize that many teachers first think about instruction from the standpoint of content. Their model is one of only a few that recognize this content orientation of teachers. Behavioral objectives are to be written and classified before making several design decisions. Their classification scheme is based on Gerlach's other scholarly work and presents a five-part cognitive taxonomy with single categories for affective and motor skill objectives.

The next step in their model is **assessing the entry behavior** of learners, a step common to many classroom oriented models. However, despite the specification of entry behavior as a major step in the ID process, few concrete procedures describing how to accomplish this step are provided. The next step includes five activities to be performed simultaneously. These activities are viewed as interactive, with any decision in one area influencing the range of decisions available in the others; e.g., the **design** process

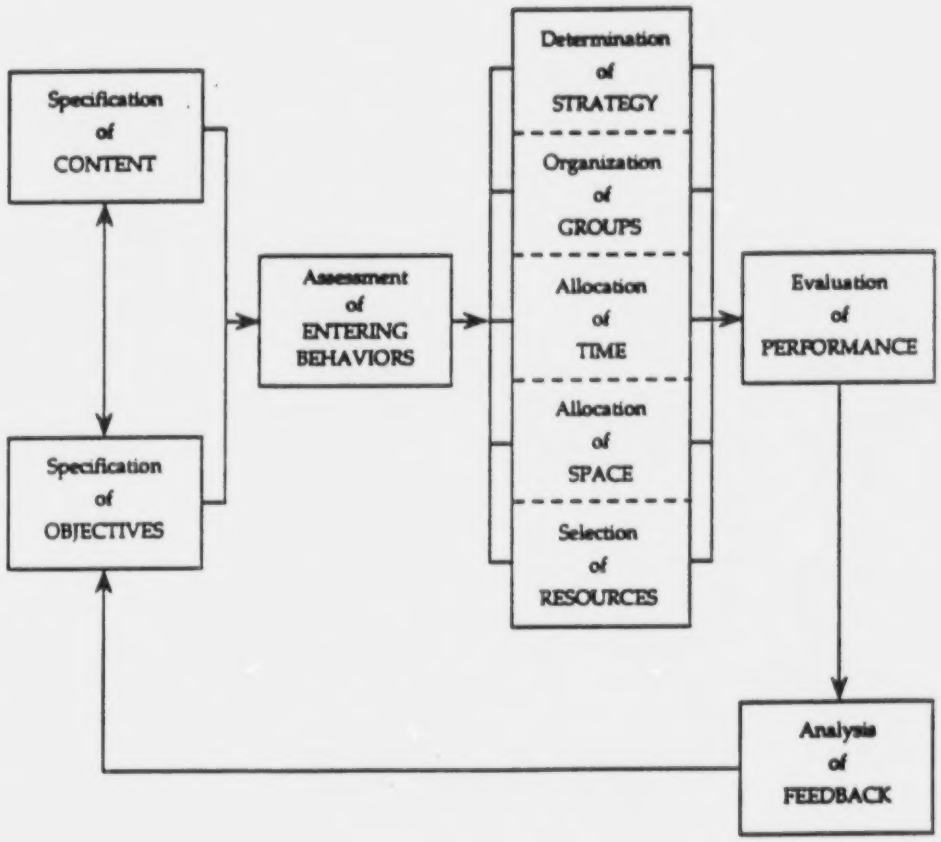


Figure 2. A systematic approach to instruction. (Gerlach/Ely/Melnick, *Teaching and media: A systematic approach* (2nd ed.) Copyright ©1980, p. 11. (Reprinted by permission of Allyn & Bacon, Needham, MA.)

is itself a system. The five activities are: (1) determine strategy, (2) organize groups, (3) allocate time, (4) allocate space, and (5) select resources.

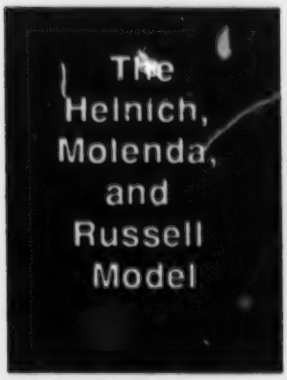
Under strategies they posit a continuum from exposition (all cues) to discovery (no cues). The teacher/designer's role is to select one or more strategies along this continuum. Students can be organized into configurations ranging from self-study to whole-class activities based on strategies, space, time, and resources. Time is viewed as a constant to be divided up among various strategies. Space is not a constant, since it is pointed out that teachers can and should extend learning experiences beyond the classroom. Also, the classroom itself can usually be rearranged for different grouping patterns.

Selection of resources focuses on the teacher's need to locate, obtain, and adapt or supplement existing instructional materials. Emphasis is placed on where and how to find such resources and the importance of previewing and planning for their use as a part of the overall instructional strategy. This emphasis on selecting rather then developing instructional materials is a common feature of classroom oriented ID models.

Following these five simultaneous decisions is **evaluation** of student performance. This step directs the teacher/designer's attention to measuring student achievement and their attitude toward the content and instruction. Evaluation is seen as closely linked to the learner objectives stated earlier, with attention also directed to evaluating the "system" itself. The last step in their model is **feedback** to the teacher regarding the effectiveness of the instruction. Feedback focuses on reviewing all earlier steps in the model with special emphasis on reexamining decisions regarding the objectives and strategies selected.

The Gerlach and Ely model is a mix of linear and simultaneous design and development steps. Several steps are seen as simultaneous, but the model is generally linear in its orientation. Its main strength is that practicing classroom teachers can readily identify with the process it describes. Its objectives classification taxonomy is simple and non-threatening to teachers. Also, the authors relate their taxonomy to specific instructional strategies. Its main weakness is that it may unintentionally reinforce teachers

and administrators in maintaining existing organizations and staffing patterns rather than re-examining the entire basis of how schools should operate.



Heinich, Molenda, and Russell (1989) present their classroom oriented instructional development model—ASSURE—in what is currently the most widely distributed college text on instructional media and technology. While some might argue it is not a complete or formal instructional development model, teachers can readily identify with the planning process it describes, and its wide circulation alone would warrant its inclusion in this review. Unlike most ID models, ASSURE is not portrayed in graphic or pictorial form. ASSURE is simply an acronym for:

A - analyze learners
S - state objectives
S - select media and materials
U - utilize materials
R - require learner participation
E - evaluation/review

The A for **Analyze Learners** acknowledges the importance of determining the entry characteristics of learners. Heinich, Molenda, and Russell caution teachers that it is not feasible to analyze all learner attributes. They suggest only selected "general characteristics" (e.g., grade level, job/position, and cultural and economic factors) and selected "specific entry competencies" (e.g., knowledge, technical vocabulary, attitudes, and misconceptions) be examined. They also suggest that "learning style" (anxiety, aptitude, visual/auditory preference, etc.) be considered, but acknowledge problems in defining and measuring these characteristics.

Their second step, S for **State Objectives**, emphasizes the need to state the desired outcomes of instruction in specific and measurable terms. A rationale for stating measurable objectives is presented, including their role in strategy and

media selection, assessment of learning, and communicating the intent of the instruction to learners.

The second S in their model, **Select Media and Materials**, recognizes that most teachers have little time for designing and developing their own materials. However, they do discuss the option of modifying existing materials and indicate that sometimes original development may be possible. The procedures and criteria they present for selecting media and materials provide useful guidelines to teachers and to those assisting teachers in that task.

The U, or **Utilize**, step in their model describes how teachers need to plan for utilizing the selected media and materials in the classroom. The practical advice they offer recognizes the realities of most American classrooms and the fact that teachers play the central role in delivering most instruction.

The R, **Require Learner Participation**, step in the ASSURE model emphasizes the importance of keeping learners actively involved. The roles of feedback and practice are also described. While one might question why learner participation is singled out over other design considerations for elevation to being a step in the ASSURE model, Heinich, Molenda, and Russell obviously think it to be of primary importance.

The last step in their model, E for **Evaluation/Review**, is in reality two steps, evaluation *and* review. They discuss the importance of evaluating the "total picture" to assure both learner achievement of the objectives and the feasibility of the instructional process itself. Review is then planned based on discrepancies between the intended and actual outcomes.

Although Heinich, Molenda, and Russell's model focuses on media and materials selection and utilization in contrast to a wider view of the ID process, their model has much to offer classroom teachers. The obvious relationship of its steps to their "real world" and its practical guidance and structure make it easy to understand and apply. Further, the well written text and accompanying teacher's manual are an excellent resource for teaching teachers the rudiments of the ID process.

The Dick and Reiser Model

In their recent book, Dick and Reiser (1989) present both an outline for an instructional plan and a development model (they use the term design) for preparing and implementing the plan (see Figure 3). While their planning structure and model are clear and well developed, they add to the confusion of terminology in the field by using design to describe both the overall process and one of its elements. They write, "A formal definition of instructional design is: a systematic process for designing, developing, implementing, and evaluating instruction. While the word *design* is repeated in the definition, it is used to represent the entire process as well" (1989, p .3).

In presenting their model, Dick and Reiser first present the skeleton of the plan they propose that teachers prepare. They then present their development model. Since the relationship of the plan to the model seems somewhat obscure, we will turn our attention directly to their model. Dick and Reiser's model starts with **setting goals**, after which specific measurable objectives are to be written. The importance of textbooks to classroom instruction is acknowledged by the authors in the interactive link they make between **writing objectives** and **selecting or reviewing the textbooks** teachers plan to use. The prominent role of textbooks in classrooms is further indicated by the arrow from textbooks back to the setting of goals. The relationship of **learner characteristics** to the content of objectives is indicated by the single headed arrow from learner characteristics to objectives.

In a somewhat unusual next step, they link both text selection/review and objectives to **test development**. They then prescribe **developing instructional activities** followed by **choosing instructional media**. It is interesting to note that Heinich, Molenda, and Russell reverse these two steps, a factor one may wish to consider in deciding which model to employ or use to communicate with others. After choosing media, the next step is to **implement the instruction**, which in their case also includes evaluating its results. The last step is to **review the instruction** by returning to the point at

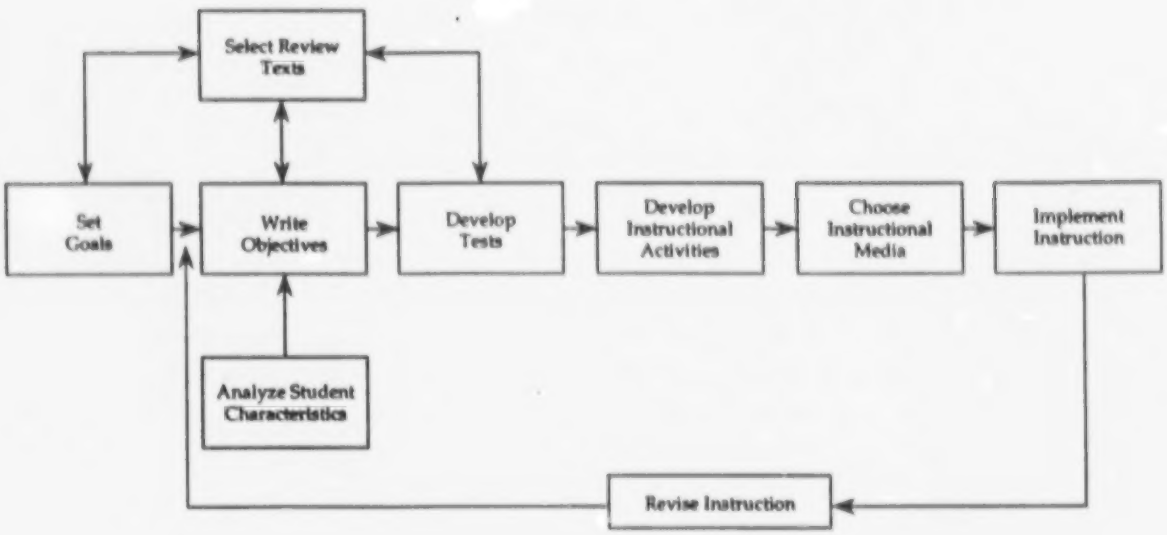


Figure 3. Model for developing effective instruction. (From *Planning effective instruction* by Walter Dick and Robert A. Reiser. Copyright ©1989. Used with permission of Allyn & Bacon.

which you wrote the objectives as you plan for the next offering of the instruction.

Dick and Reiser's model and accompanying narrative are straightforward and easy to comprehend. The process they describe is influenced by their experience and expertise in educational psychology, measurement, and evaluation. While the amount of detail concerning how to perform each step in the process is somewhat limited, the text does provide a sound introduction to the concepts of instructional development for classroom teachers.

The Kemp Model

Jerrold Kemp's model (1985) (see Figure 4) is similar in a number of ways to Gerlach and Ely's. He states that there are four essential elements of instructional technology: (1) students; (2) what must be learned (objectives); (3) what procedures and resources will work best to reach desired learning levels (methods); and (4) how we will know when the required learning has taken place (evaluation). Kemp's model communicates his belief that ID is a continuous cycle with revision as an on-going activity associated with all of the other elements. He feels that the teacher/designer can start anywhere and proceed in any order. This is essentially a general system view of development wherein all elements are interdependent and may be performed simultaneously if appropriate.

Although Kemp's model indicates that the developer can start anywhere, its accompanying narrative is presented in a conventional framework starting with **Topics–Job Tasks and Purposes**. The classroom orientation of the model is apparent through Kemp's choice of words, topics, and subject content for determining what will be taught. These words can be readily accepted by classroom teachers.

Kemp's second element is to enumerate important **Learner Characteristics**. These include such academic factors as number of students, GPA, IQ, and reading level, and such social factors as age, maturity, and attention span.

The model's third element is to conduct a **Subject Content Task Analysis**.

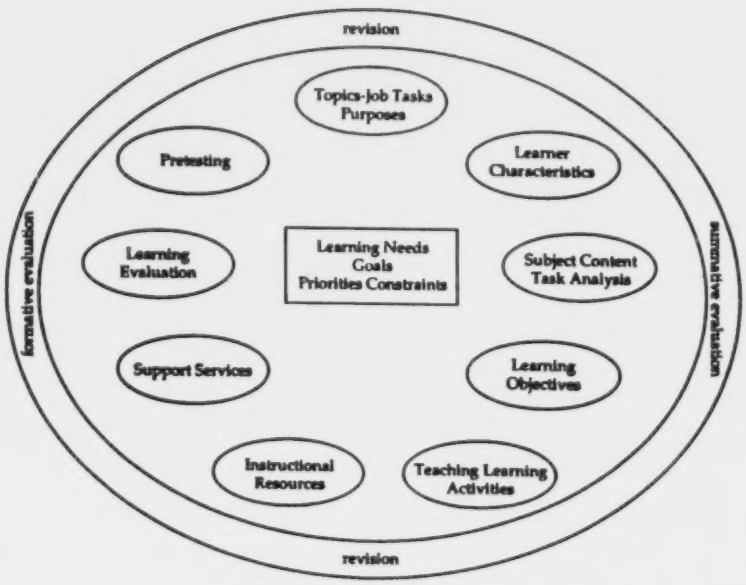


Figure 4. (From *The instructional design process* by Jerrold E. Kemp. Copyright ©1985 by Harper & Row, Publishers, Inc. Reprinted with permission of HarperCollins Publishers.)

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The fourth element is the specification of **Learning Objectives**. He suggests using Bloom's taxonomy for categorizing objectives and ensuring that a broad range of objectives is included.

Element five, **Teaching/Learning Activities**, is the step at which decisions are made regarding instructional strategies, grouping, media, and other resources. Kemp combines into this step most of what Gerlach and Ely have separated into five elements in their model. For this step he presents a set of "principles for successful learning" and describes a variety of teaching and learning models with accompanying lists of their advantages and disadvantages.

Element six, **Instructional Resources**, contains descriptions of a variety of media and their relative attributes.

Element seven, **Support Services**, deals with the budget, facilities, time, equipment, personnel, and materials required to engage in the development process.

Element eight, **Learning Evaluation**, addresses different forms of testing and stresses the importance of matching test requirements of previously stated objectives.

Element nine, **Pre-testing**, describes the importance of determining learners' prior knowledge of the content of the course under development and their general abilities that are relevant to successful achievement of the objectives.

The "band" that encircles the model includes **Revision** (a continuous process) and **Formative and Summative evaluation**, also conceived as on-going in the classroom environment.

The box in the center of the model—**Learning Needs, Goals, Priorities/Constraints**—deals with the general question of whether instruction is appropriate or needed, and if so why and what its general goals are.

From a teacher's perspective, the strength of Kemp's model is the concept of starting "where you are." Also, the emphasis on subject matter content, goals and purposes, and selection of resources makes it attractive to teachers. Its major weaknesses are the lack of specification in the elements dealing with teaching/learning activities, formative evaluation, and revision. The version of Kemp's model reviewed here is different than the one reviewed in the ear-

lier edition of this survey. The current version places greater emphasis on both formative and summative evaluation as on-going processes and places all activities within the context of Goals, Priorities and Constraints. Kemp is one of very few authors who has modified his ID model over time.

PRODUCT DEVELOPMENT MODELS

Assumptions

Product development models are characterized by four key features: (1) they usually assume that the instructional product is needed; (2) they assume something should be produced rather than selected or modified from existing materials; (3) they place considerable emphasis on tryout and revision; and (4) they assume that the product must be usable by a variety of "managers" of instruction. The assumption of need should not necessarily be considered a limitation of these models. In some settings a front-end analysis has already been conducted and needs determined for a variety of products. The task then becomes developing the products efficiently and effectively. Also, in a number of situations, the need is so obvious, that it is unnecessary to ask "should," but only "what" should be done. An example would be the necessity for developing an operator training package for a new machine that is about to be marketed.

Extensive tryout and revision often accompany product development because the client cannot, or will not, tolerate low performance. Also, the performance level may be externally established; e.g., the user must be able to use all of the capabilities of the word processing software. This is in contrast to classroom settings where the performance level is often subject to considerable up or down adjustment based on the effectiveness of the instruction. Cosmetic appearance of the product may also be important to clients, thus making subjective evaluation an important part of the tryout process. Use of the product by managers as opposed to teachers simply means the product is often required to

stand on its own without a content expert available to the learner. An example would be training for a telephone company lineman on how to install a specialized piece of equipment. The demand for free standing products is another reason for emphasizing tryout and revision in product development. As computer-based instruction has become more popular, the demand for effective instructional products has increased and is likely to expand even more rapidly in the future. Hence, the demand for efficient and effective prescriptive development models, unique to a variety of settings and products, will probably accelerate in the decade of the 90s.

Product models often contain elements that might qualify them as systems models (to be presented in the next section). Those chosen for this review were selected based on the belief that they are *primarily* focused on creating instructional products rather then more comprehensive instructional systems. The three models reviewed are by Van Patten (1989), Leshin, Pollock, and Reigeluth (1990), and Bergman and Moore (1990). For examples of earlier product models see the previous edition of this publication (Gustafson, 1981).

The Van Patten Model

Van Patten's model is described in the chapter he wrote for the book *Instructional Design: New Alternatives for Effective Education & Training* edited by Johnson & Foa (1989). His introduction to his model is a little confusing because he first talks about the instructional design process as performed by instructional designers to produce products. Later, however, he talks about the process as Instructional Systems Design (ISD).

Van Patten claims that the ISD model which he presents and describes (see Figure 5) can be used to create paper-based instructional materials. It has nine phases, each having a deliverable, one or more persons responsible for its execution, and one or more persons responsible for its evaluation. These phases are: Analysis, Design, Development, Pilot Test, Review, Production, Duplication, Implementation, and Maintenance. **Analysis** includes defining the problem, identifying the audience, determining

Phase	Deliverable	Created by	Evaluated by
Analysis	Analysis Report	Designer/Evaluator	Client
Design	Specification	Designer	Client/SME
Development	Draft materials	Developer/Designer	Client/SME
Pilot test	Test results	Designer/Evaluator	Client/SME
Revision	Final materials	Developer/Editor	Client/SME
Production	Camera-ready	Editor/Graphics	Client/SME
Duplication	Inventory	Graphics/Printer	Client/Administrator
Implementation	Training begins	Instructor/Administrator	Client
Maintenance	Periodic Evaluations	Instructor/Designer Administrator/Evaluator	Client

Figure 5. (From J. Van Patten: What is instructional design? Reprinted with permission of Macmillan Publishing Company from *Instructional design: New alternatives for effective education and training*, K. A. Johnson & L. K. Foa (Eds.) Copyright ©1989 by the American Council and Macmillan Publishing Company, a Division of Macmillan, Inc.).

resources, and specifying the goals of the effort. The **Design** phase involves preparing the "floor plan" and "pen and ink" renderings of design specifications. The **Development** phase has four subphases; developing definitions of each topic, developing examples for each definition, developing practice exercises for the examples, and developing "everything else." Phases four and five, **Pilot Test** and **Review**, are described together as an interactive loop that is repeated until the instruction is judged "good enough." Phase six, **Production**, is the step at which all materials are put through final production and prepared for duplication. Duplication is essentially the task of building an inventory of material in preparation for its distribution. Phases eight and nine, **Implementation** and **Maintenance**, are described together as an interactive loop that takes place as long as the product continues to be used.

Van Patten's model is similar to other product models in that it specifies extensive tryout (Pilot Test and Review) before the product is finalized. It also specifies implementation and maintenance, activities not always associated with product development. If the product is publicly marketed, no formal implementation or maintenance (in Van Patten's use of the terms) would likely occur. Van Patten's model is quite serviceable as a general guide, but its lack of operational detail limits its use to those already familiar with specific procedures for performing the activities he describes.

The Leshin, Pollock, and Reigeluth Model

Leshin, Pollock, and Reigeluth (1990) have developed a model (see Figure 6) that they claim redresses the shortcomings of other models which "have not included any guidance for the selection and use of instructional strategies and tactics" (p. 1). While the creators of many of the other models might disagree with their statement, their point is well taken. Many models place heavy emphasis on the analysis side of activities with the actual design of instruction receiving considerably less attention. Leshin, Pollock, and Reigeluth's model is significantly influenced by Reigeluth's and others' earlier work in elaboration theory and recent developments

Overview of the Instructional Design Process

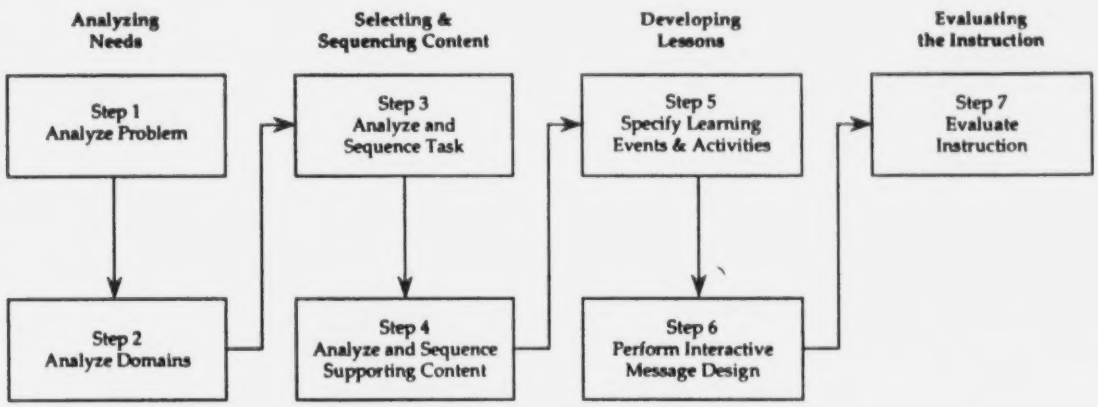
Analyzing Needs
Selecting & Sequencing Content
Developing Lessons
Evaluating the Instruction
Step 1 Analyze Problem
Step 2 Analyze Domains
Step 3 Analyze and Sequence Task
Step 4 Analyze and Sequence Supporting Content
Step 5 Specify Learning Events & Activities
Step 6 Perform Interactive Message Design
Step 7 Evaluate Instruction

Figure 6. Overview of the instructional design process. (From *Instructional design: Strategies and tactics for improving learning and performance* by C. Leshin, J. Pollack, and C. Reigeluth. Copyright © by Educational Technology Publications, in press. Used with permission of Educational Technology Publications.)

in cognitive psychology. Although the graphic representation of their model appears to be linear, they emphasize the cyclical and non-linear nature of the development process in the accompanying narrative.

Leshin, Pollock, and Reigeluth's model contains only seven steps, which are clustered under four headings: Analyzing Needs, Selecting and Sequencing Content, Developing Lessons, and Evaluating the Instruction. Step one is to **Analyze the Problem**, which can be a performance deficiency in a training situation or simply a lack of knowledge in an educational setting. Identifying the audience, clearly stating the problem, determining possible solutions, and communicating the results are all part of this first step. Step two, **Analyze the Domains**, contains four subcomponents: identify tasks, identify performance deficiencies, write performance objectives, and develop performance measures. Step three, **Analyze and Sequence Tasks**, contains eight components not elaborated upon in this review, but heavily influenced by elaboration theory. Step four, **Analyze and Sequence Supporting Content**, is also based on Reigeluth's earlier work and provides considerable detail on how to perform these tasks. Step five, **Specify Learning Events and Activities**, involves classifying each piece of content as to type of learning, planning instructional "strategies and tactics," writing practice and test items, and specifying the instructional management plan. Step six, **Perform Interactive Message Design**, is essentially an examination of five alternate delivery systems along with a set of general considerations for message design. Step seven, **Evaluation**, consists of three components: one-on-one evaluation, pilot testing, and summative evaluation via field testing.

In summary, Leshin, Pollock, and Reigeluth have created a seven step model specifically to address their belief that greater attention is needed to what some have called the psychological components of instructional design. Their model really exists on three levels of detail, but they have not chosen to highlight this feature. Its strength is the existence of numerous "job aids" to guide the development process. These job aids will be of considerable assistance to novice instructional developers. Its major limitations are the lack of attention to project management and to implementation.

The Bergman and Moore Model

Bergman and Moore (1990) recently published a model (see Figure 7) directed at producing "Interactive Video/Multimedia" products. Their model focuses on one of the current areas of keen interest in education and training technology. Although their model includes specific reference to interactive video (IVD) and multimedia (MM) products, it is generally applicable for a variety of "high-tech," interactive instructional products. With only a few changes it could readily pass for one of several earlier product models that focused on the then current high technology such as Control Data Corporation (see Gustafson, 1981).

Bergman and Moore's model contains six major activities: Analysis, Design, Develop, Production, Author, and Validate. For each activity they specify input, deliverables (output), and evaluation. As can be seen, the output of each activity provides the input for the subsequent activity. They refer to each horizontal row of their model as a "phase" and remind the reader that although not shown, it may be necessary to "review a phase and review selected activities." They also emphasize the importance of evaluating the output (deliverable) from each activity before proceeding. The checklists they provide for performing these evaluations are extensive, and would be valuable even if one were using a different product development model for IVD or MM development.

Bergman and Moore report that a request for proposal (RFP) initiates the development process. They suggest that even if an external RFP does not exist, preparing an internal RFP is desirable. The RFP drives **Analysis** activities including identification of the audience, tasks, user environments, and content. **Design** activities include sequencing the major segments and defining their treatment, labeled by Bergman and Moore "High-Level Design." Detailed design then follows and includes specification of motivational elements, media, interaction strategies, and assessment methodology. **Development** includes preparing all of the documents necessary for later production. Examples of what Bergman and Moore call "Producible Documents" are storyboards,

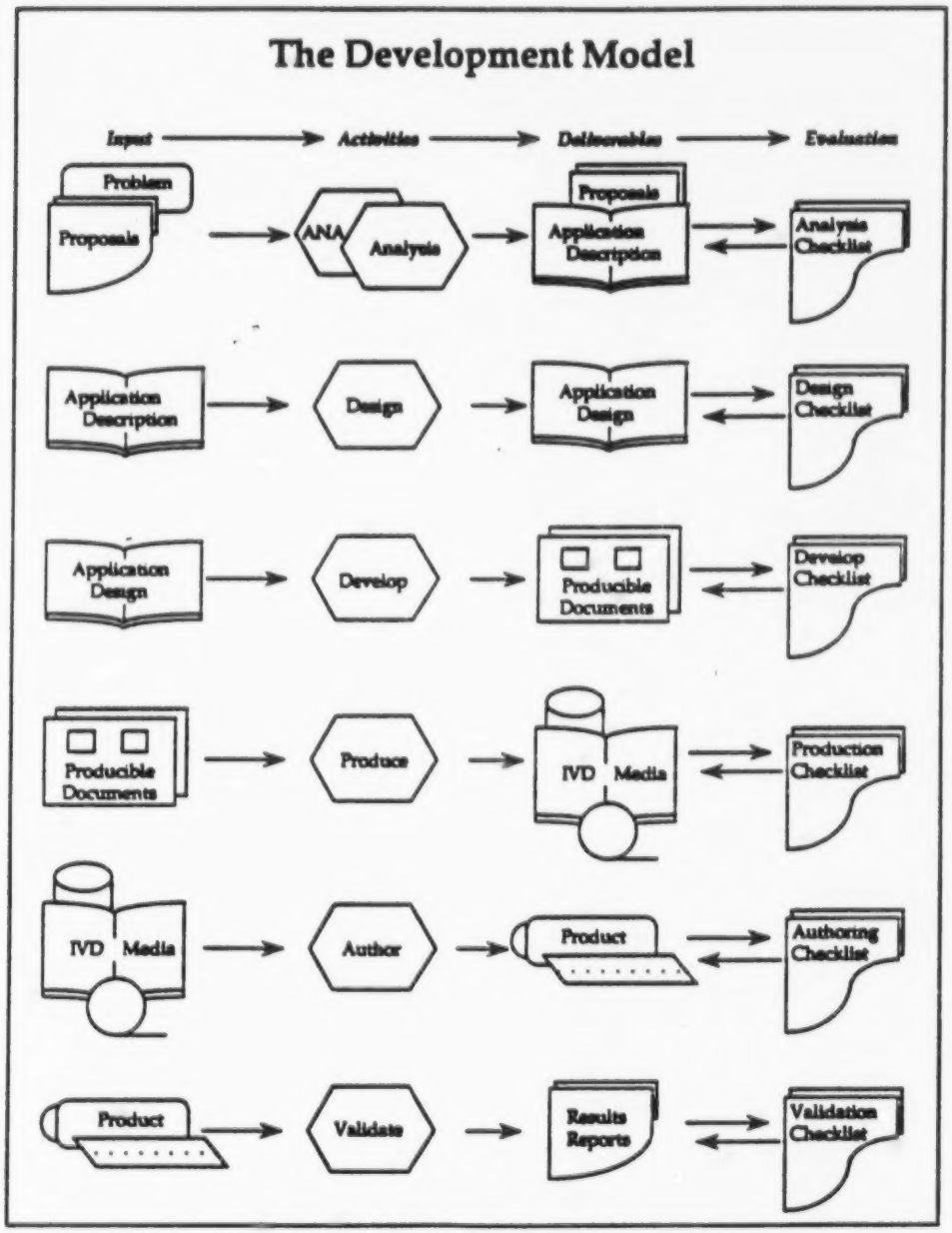

Figure 7. The development model. (From *Managing interactive video/multimedia projects* by Robert E. Bergman and Thomas V. Moore. Copyright ©1990 by Educational Technology Publications. Used with permission of Educational Technology Publications.)

audio scripts, shot lists, art and graphics renditions, and a database for managing production. **Production** "transforms the producible documentation into its corresponding medium: video sequence, audio, graphic, or text." **Authoring** activities integrate the individual media into the completed product. Its three sub activities are coding, testing, and tuning. **Validation** consists of comparing the finished product with its original objectives. Revision may also occur at this time, as can assessment of the product's achievement of its sponsor's goals.

Development of sophisticated IVD and MM products almost always requires a team, a point made repeatedly by Bergman and Moore. IVD and MM also require a sound management system, the structure for which this model provides. This model was selected for review partially because of its focus on new technology, and partially because of the excellent and extensive checklists and other guides contained in the text. Even without the model the support materials are well worth examining.

SYSTEMS DEVELOPMENT MODELS

Assumptions

Instructional systems models are characterized by four key features: (1) large scale team development, (2) a linear development process, (3) wide distribution of the system, and (4) a problem solving orientation. The models usually begin with a data collection phase to determine the feasibility and desirability of developing an instructional solution to a "problem." A number of the models require that a problem be specified in a given format before proceeding. Thomas Gilbert's (1978), Mager and Pipe's (1984), and Rossett's (1987) work in front-end analysis is highly relevant to the models discussed herein. Their position is that, while a problem may have an instructional solution, one should first consider lack of motivation and environmental factors as alternative areas of action. Systems models, as a class, differ from product development models in the amount of emphasis placed on analysis of the larger environment before committing to development. Systems models also typically assume a larger scope of effort than product development models. However, in the design, development, and evaluation phases, the primary difference between systems models and product models is one of magnitude rather than type of specific tasks to be performed.

Five systems oriented models were selected for review. The first two are classics that appeared in the earlier edition of this publication, but because of their continued notoriety are included here as well. The other three are of more recent vintage. The five models selected for review are: (1) Instructional Development Institute (IDI); (2) Interservices

Procedures for Instructional Systems Development (IPISD); (3) Dick and Carey; (4) Seels and Glasgow; and (5) Diamond.

The IDI Model

The Instructional Development Institute (IDI) model (see Figure 8) is one of the most widely publicized ID models in existence. It is taught in many professional preparation programs, and has been the focus of a national workshop for large numbers of public school personnel. In the earlier ERIC paper by Twelker *et al.* (1972), the IDI model provided the frame of reference for analyzing other models. The model is a joint effort of the University Consortium for Instructional Development and Technology (UCIDT), which was originally known as the National Special Media Institute. Created as a tool for public school personnel who desired to tackle large-scale instructional problems, the IDI model is problem oriented, specifies team development, and assumes distribution or dissemination of the results of the effort. It is similar in a number of its steps to an earlier model created by Dale Hamreus, and some developers consider it as simply a variation on his model.

The IDI model is essentially linear in its approach. The claim is briefly made that ID can be non-linear, but the procedures accompanying the graphic model provide no evidence of how this can be accomplished. The model has three stages and nine steps, with each step further subdivided for a total of 24 elements. In essence, the model is conceived as being useful at all three levels of detail—stages, steps, or elements.

The model is reviewed here at its intermediate level of detail since describing it at the 24-element level would result in a lengthy description. The IDI's first step is to **Identify the Problem**. This requires conducting a needs assessment, establishing priorities among various and conflicting needs, and, finally, stating one or more problems to be addressed. Emphasis is placed on separating symptoms from problems and stating problems in measurable terms. This permits later assessment of progress toward alleviating or solving the stated problems. Step two (**Analyze the Setting**) specifies additional data collection to be performed regarding the previously stated problem. Data are collected

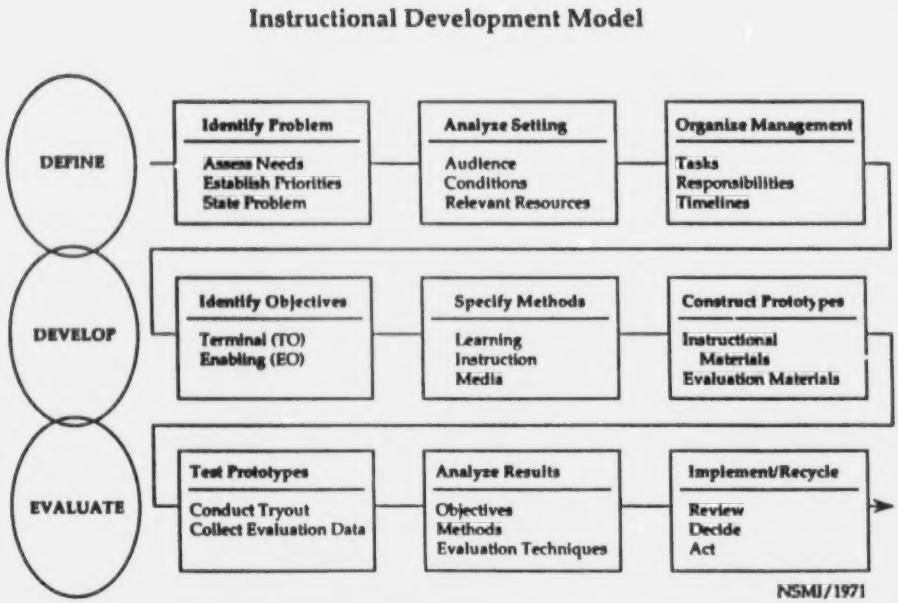

Figure 8. The Instructional Development Model (IDI). (From the University Consortium for Instructional Development and Technology; formerly the National Special Media Institute).

concerning audience (learner) characteristics, characteristics of other affected personnel, conditions under which development must occur, constraints on any solution, and what relevant material and human resources are available for both developing and delivering the solution.

Step three is to **Organize Management**, including the development team. This step is somewhat unique to the IDI model. Its creators made this step highly visible because of their belief that poor management often leads to failure of development efforts. Organizing management includes stating all major tasks, assigning responsibility for those tasks to team members, and establishing timelines for their completion. Monitoring of progress is also included as part of this step. How a team is to perform steps one and two before becoming organized is never explained.

Step four (**Identify Objectives**) is similar to other models in requiring behaviorally stated objectives. The mnemonic ABCD provides a helpful reminder that objectives must include an Audience (A), Behavior (B), Condition (C), and Degree of performance (D). Step five (**Specify Methods**) uses a taxonomy developed by Edling and Hamreus (later modified by Merrill and Goodman, 1972) for classifying objectives, and then selecting strategies and media based on the type of objective. The strategies and media prescription matrix is viewed as a set of suggestions rather than a rigid matching activity. Designers and developers are encouraged to use whatever additional knowledge they have to make final determinations.

Step six (**Construct a Prototype**) prescribes building testable drafts of all the materials. These include instructional units, teacher/manager instructions, and evaluation materials. The emphasis is on constructing a prototype that is complete enough to test, but not so expensive that it cannot be changed. The seventh step specifies **Testing the Prototype** under conditions as similar as possible to its eventual use. This step is often called formative evaluation in other models. Step eight specifies **Analyzing the Results** in terms of learner achievement, effectiveness and practicability of the methods of instruction, and appropriateness of the evaluation techniques. The last step in the IDI model is to **Recycle** (if the data indicate a deficiency) or to **Implement** the solution if it is effective. Recycling to any

previous step should be considered, but it may be necessary to return to the original problem and re-analyze needs. It should be noted that, in recent years, the UCIDT Consortium has developed a workshop on dissemination that is an extension of the model to another step, but the original model has not been modified.

The basic strength of this model is its three levels of detail. This permits its initial presentation to non-developers in a simple form that can be elaborated as their knowledge increases. Its basic limitation is the implication of a linear step-by-step development process beginning with definition of a problem. This limitation is common to many systems models. Its processes are also becoming dated due to a lack of refinement in over ten years.

The IPISD Model

The Interservices Procedures for Instructional Systems Development (IPISD) model (see Figure 9) is, as the name suggests, a joint effort of the U.S. military services. The Army, Navy, Marines, and Air Force created this model in the interest of utilizing a common approach to instructional development. The motivation was to facilitate shared development efforts and improve communication with contractors engaged in instructional development across different branches of the military. Of course, the underlying concern of each service was to have a rigorous procedure for developing effective instruction. A large number of personnel contributed to creating the IPISD model; however, the name most commonly associated with it is Robert Branson.

The IPISD model is similar to the IDI model in that it has several levels of detail. At its simplest level it has five phases: analyze, design, develop, implement, and control. These phases sub-divide into 20 steps which can be further divided into hundreds of sub-steps. In fact, the IPISD model is one of the most highly detailed models of the ID process generally available. It is published as a four volume set (Branson, 1975) and can be ordered from the National Technical Information Service (NTIS) or ERIC.

Since a detailed review of all the steps in this model is beyond the scope of this survey, it will be reviewed only at the phase level. The reader should keep in mind that the

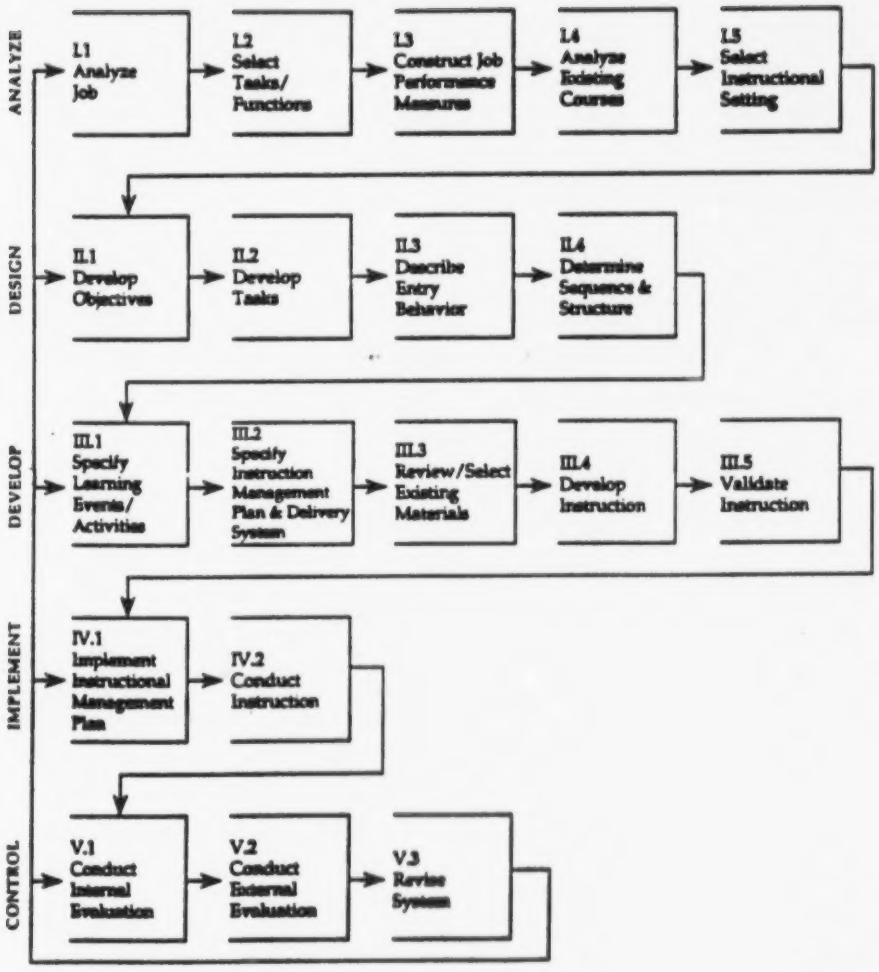

Figure 9. IPISD model: Detailed breakdown of activities to be performed in each phase. (From *Interservice procedures for instructional systems development: Executive summary and model.* TRADOC Pamphlet 350-30, August 1, 1975.)

IPISD approach is designed specifically for military training in the skills/job area; most other models have a much broader range of intended applications. The narrower focus of IPISD is both a blessing and a bane. Its virtue is the extremely detailed level of specification it contains. However, the price of this specification is its lack of generalizability to other environments.

Phase one of IPISD (**Analyze**) requires specification of the tasks personnel perform on the job. Tasks which are already known or easy to acquire are subtracted, and a list of tasks requiring instruction is generated. Performance levels and evaluation procedures are specified for the tasks and existing courses are examined to determine if any of the identified tasks are included. A decision is then made either to modify the existing course to fulfill task requirements or to plan a new course. In the latter case, parts of an existing course may be adapted for the new one. The final step in phase one is to determine the most appropriate site for instruction; i.e., school or non-resident instruction.

Phase two (**Design**) begins with the arrangement of job tasks into instructional outcomes classified by the learning elements involved, i.e., mental skills, physical skills, information, and attitudes. Tests are generated and validated on a sample of the population and instructional objectives written in behavioral form. Next, the entry behavior expected of typical students is determined, followed by the design of the sequence and structure for the course. Design specifications are then forwarded to phase three of the process.

The development of prototype materials occurs in phase three of the model. **Development** begins by specifying a list of events and activities for inclusion in instruction. Media are then selected and a course management plan developed. Existing instructional materials are reviewed for their relevance and, if appropriate, adopted or adapted for the course. Necessary new materials are then produced and the entire package field tested and revised until satisfactory learner and system performance are achieved. The development phase concludes when the entire course package is ready for large scale implementation as phase four of the model.

Phase four (**Implement**) includes training for course managers in the utilization of the package, content training

of subject matter personnel, and distribution of all materials to the selected sites. Instruction is then conducted and evaluation data collected on both learner and system performance.

Phase five (**Control**) is the last part of the IPISD model. Internal evaluation is performed by "on-line" staff who are expected to make small-scale changes to improve the system after each offering. In addition, they forward evaluation results to a central location. External evaluation is a team effort directed toward identifying major deficiencies requiring immediate correction. External evaluation also follows course graduates to the job site to assess real-world performance. Changes in practice in the field are also monitored to determine necessary revisions to the course. Thus, the emphasis in phase five is on quality control and relevance over an extended period of time.

The major strength of the IPISD model is the extensive specification of procedures to follow during the ID process. It is an excellent reference for students who are in training to become instructional developers or managers of ID contracts. To augment its already extensive resources, Berkowitz and O'Neil (1979) prepared an annotated bibliography of additional relevant resources for the IPISD model. Its major limitations are its narrow instructional focus and linear approach to ID. Further, the level of analysis and prescription it specifies could be done only by a heavily staffed, highly financed organization. Use of this model requires a commitment of substantial resources on a long-term basis. This model will find little use outside of the military, the government, and a few large corporations having major job training programs.

The Dick and Carey Model

Walter Dick and Lou Carey (1990) have produced one of the most widely used introductory texts on instructional development; hence its selection for inclusion in this publication. The Dick and Carey model (see Figure 10) might be considered product oriented rather than system oriented depending on the size and scope of step one activities (Identify Instructional Goals). Many of the examples and worksheets seem to

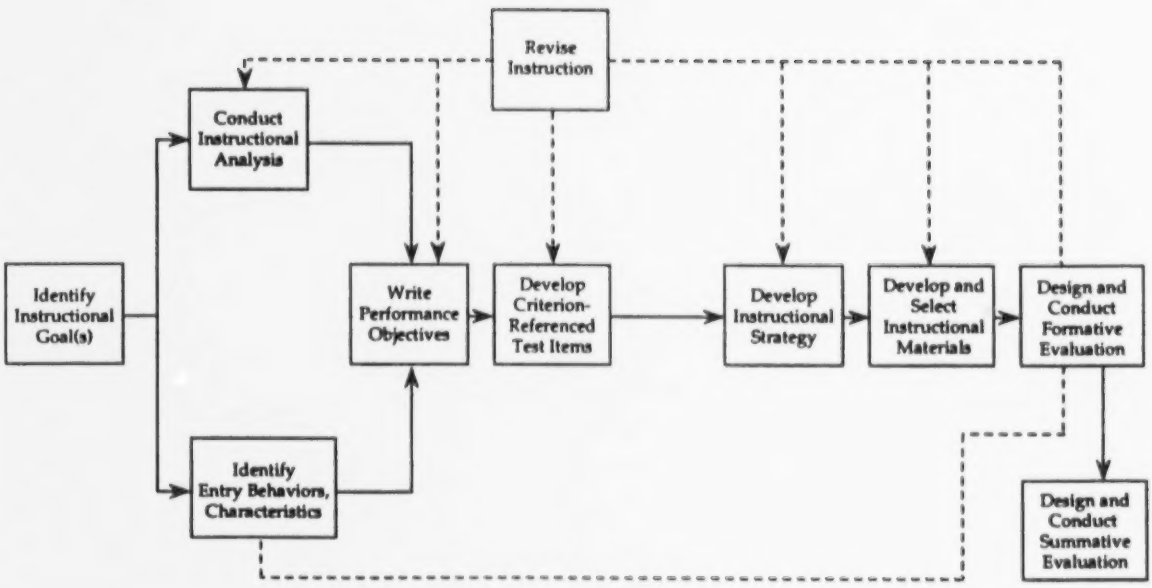

Figure 10. (From *The systematic design of instruction, 3rd edition* by Walter Dick and Lou Carey. Copyright ©1990 by Walter Dick and Lou Carey. Reprinted by permission of HarperCollins Publishers).

be directed at developing specific instructional products, but parts of the narrative suggest a more encompassing perspective. For our purpose we consider it to be a systems model that is also applicable to projects having a more limited focus. It should also be noted that they use the term instructional design for the overall process, which we have defined as instructional development.

Dick and Carey's model begins with **Identify Instructional Goal(s)**. Here they emphasize the importance of deciding what you are trying to achieve before preceding. Two steps are then done in parallel: **Conduct Instructional Analysis** and **Identify Entry Behaviors and Characteristics**. The former is vintage hierarchical analysis as conceived by Gagné. The latter step specifies collecting information about prospective learners' knowledge, skills and attitudes. Facilitative prerequisites as defined by Gagne are also examined. The next step is to **Write Performance Objectives** in measurable terms. Criterion referenced test items are then generated for each objective. One of the strengths of this model is its emphasis on developing tests having defensible validity and reliability. **Developing an Instructional Strategy** for each objective comes next and again closely hews to prescriptions promulgated by Gagné. To achieve the specified strategies the next step is to **Develop and Select Instructional Materials**. To their credit Dick and Carey acknowledge the desirability of selecting as well as developing materials, but the degree of emphasis devoted to development suggests they are far more interested in performing original development. The next step is to **Design and Conduct Formative Evaluation**, a process for which they give excellent guidance. The last step, that interestingly is placed on a lower line then those preceding it, is **Design and Conduct Summative Evaluation** to determine the degree to which the original instructional goals (and perhaps other unintended ones) have been achieved. A super-ordinate activity, **Review** occurs across all but the first and last steps in the process, indicating their belief that the output should be examined and revised as appropriate at all intermediate steps. However, little guidance is provided on how to accomplish this systematic revision at each step.

In summary, Dick and Carey have published a widely adopted introductory text and their model is well known by many professionals in the field. Although it is readily applicable to developing finite instructional products, it can also be applied at the broader level of developing instructional systems. The text is a valuable resource, especially for novice developers wanting to know more about how to engage in instructional development.

The Seels and Glasgow Model

In their recent book *Exercises in Instructional Design*, Seels and Glasgow (1990) review several instructional development models including some of those reviewed here. They then present their own model (see Figure 11), although, as the title of the text indicates, they use the term instructional design to define the comprehensive process defined as instructional development in the present publication. The Seels and Glasgow model is in most ways similar to other systems models. Its single somewhat unique element is including project management as an encompassing activity that pervades the entire process. Their inclusion of project management in this manner was the basic reason for selecting this model for review.

The Seels and Glasgow model specifies ten major activities. And, as noted, "the steps are undertaken within the parameters of the project management plan" (p. 57). Although Seels and Glasgow report that there is some "back and forth" activity among the steps, their visual representation of the model contains no such indication. **Problem Analysis** (step one) includes deciding whether there is an instructional problem by performing a needs assessment and then stating the problem. **Task and Instructional Analysis** (step two) involves collecting information on performance standards and determining prerequisites. **Objectives and Tests** (step three) are written in behavioral and measurable form and assessed via criterion referenced test items. **Instructional Strategy** (step four) involves determining the components of instruction, "such as presentation or practice conditions." **Media Decisions** (step five) include "methods and media" to meet the conditions specified in step four. **Materials Development** (step six) is

Seels And Glasgow Id Model

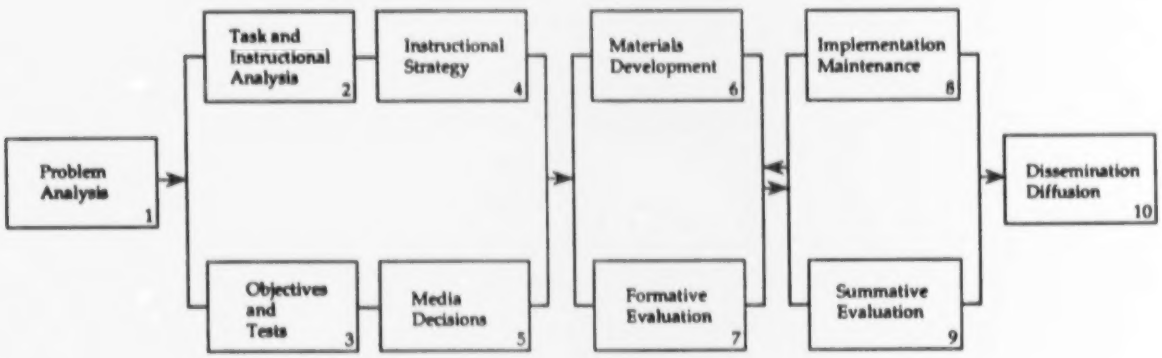

Figure 11. Instructional design model: Project management. (Reprinted with permission of Merrill, an imprint of Macmillan Publishing Company, from *Exercises in instructional design* by Barbara Seels and Zita Glasgow. Copyright ©1990 by Merrill Publishing Company.)

the point at which production occurs. Their description of typical production activities is limited to instructional materials, but elsewhere they indicate management materials are also needed. **Formative Evaluation** (step seven) includes both data collection and revision as appropriate. **Implementation Maintenance** (step eight) recognizes the need to plan for both short term and extended use of the instruction by users other than the developers. **Summative Evaluation** (step nine) seems to address the question of whether the system is solving the originally stated problem, but Seels and Glasgow do not elaborate on this point. Similarly **Dissemination Diffusion** (step ten) is not elaborated by the authors.

In summary, the Seels and Glasgow model is quite similar to many ID models in the literature, a fact they have readily acknowledged by comparing it to a five step generic model, i.e., Analysis, Design, Development, Implementation, and Evaluation. Despite a brief discussion of its non-linearity, they present it in essentially linear form. Their book is particularly useful to novice developers due to the large number of application exercises it contains. However, the treatment of the ten steps is uneven, with those addressing analysis receiving much more attention than later steps such as Implementation Maintenance and Dissemination Diffusion. An instructor's manual is also available.

The Diamond Model

Robert Diamond (1989) developed and refined over a number of years a development model (see Figure 12) that is specific to higher education institutions. Although Diamond's model might be considered classroom oriented, we have placed it in the systems category because of his belief that development is a team effort and is often directed at total curricula in addition to individual courses. Diamond also emphasizes the need to be sensitive to political and social issues existing on the campus and within academic departments. Assuring that the proposed development effort is consistent with organizational priorities and missions is another critical concern to Diamond. He believes that it is a team process with significant input from university personnel specifically assigned to assist faculty. For these reasons,

Process For Educational Program Development

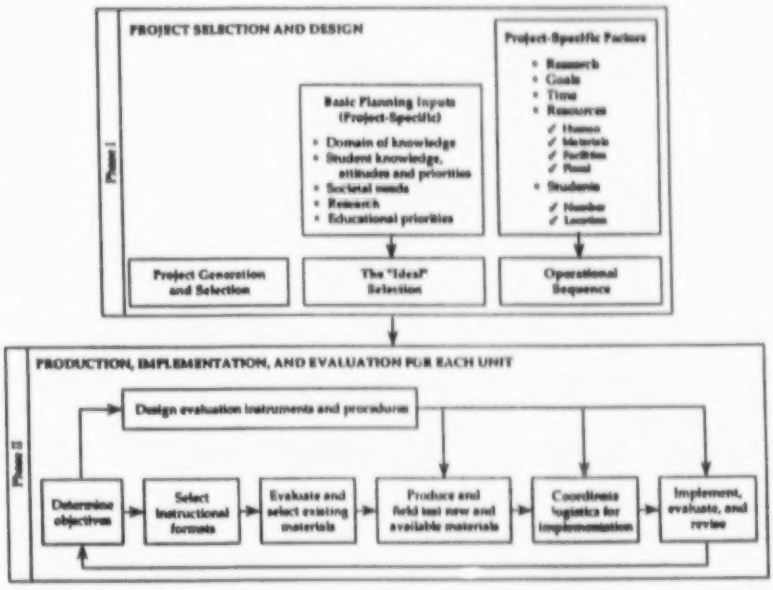

Figure 12. Process for educational program development. (From *Designing and improving courses and curricula in higher education* by Robert M. Diamond. Copyright ©1989 by the author. Reprinted with permission.)

his model seems most appropriate for classification as a systems model.

Diamond's model is divided into two phases, with Phase I including **Project Selection and Design**, and Phase II including **Production, Implementation, and Evaluation**. During phase one the feasibility and desirability of launching the project are examined. Instructional issues such as enrollment projections, level of effectiveness of existing courses, and institutional priorities, in addition to faculty enthusiasm, are all weighed before commencing development. At this point Diamond urges thinking in terms of an "ideal" selection without regard to existing constraints. His argument is that by thinking in ideal terms, a team will be more creative and innovative in outlining powerful solutions. Once a decision is made to begin a project, an operational plan is developed that accounts for the goals, timeline, human and other resources, and student needs in the involved department.

During phase two of development, each unit of the course or curriculum proceeds through a seven step process. The first step is to determine the unit's objectives. This is followed by the design of evaluation instruments and procedures, a step which proceeds concurrently with selecting the instructional format and examining existing materials for their possible inclusion in the system. Once these steps have been accomplished, any new materials are produced and modifications made to any that exist but require modification. Interestingly, Diamond includes field testing as part of the same step as materials production although most model developers make them separate steps. Also implicit to this step is revision of the unit based on field test data, but Diamond includes revision later in the process. The next to the last step is coordinating logistics for implementation, followed by full scale implementation including evaluation and revision.

In summary, Diamond's model is designed specifically for higher education environments. He emphasizes matching the decision on whether to engage in instructional development to institutional as well as instructional issues. He also stresses the need to assure faculty ownership of the results of the development effort and the need for a formal organization to support faculty's development efforts.

Diamond's model is particularly recommended for instructional developers working in higher education institutions.

SUMMARY

This review of representative ID models may leave you unsure of how to react to such a wide variety of models. The literature is replete with models, each claiming to be unique and deserving of attention. However, while there are hundreds of models, there are only a few major distinctions among them. Many of the models are simply restatements of earlier models by other authors using somewhat different terminology. Also, there is a disturbingly small volume of literature describing any testing of the models. While no one can be certain, it appears that well over half of the ID models have never actually been applied, never mind rigorously evaluated. The typical publication containing an ID model simply describes its major steps or stages and perhaps how they are to be performed. The author(s) usually assumes the model is worthwhile, but presents no evidence to substantiate that position. In a few instances, a case study of an actual development project is presented along with the model, but even this low level of validation is relatively uncommon.

It can only be hoped that in the future some ID models will be subjected to rigorous scientific validation. Such validation would require precise descriptions of the elements of the model followed by systematic data collection concerning the application and impact of those elements. The investigator would also need to be alert to possible discrepant data not accounted for in the model. Repeated trials under such conditions would, if the model had any validity, result in a precise set of findings regarding the conditions under which the model was valid. It is safe to say none of the models currently available in the literature has been sub-

jected to such rigorous scrutiny. In fact, most authors completely ignore the issue of what conditions should be present if one plans to use their model. For a more complete discussion of procedures for validating a model, the reader is referred to an excellent chapter on models and modeling by Rubenstein (1975) and the more recent work by Richey (1986).

What then, should be the response of the responsible ID professional to the plethora of unvalidated ID models? It is suggested that developers acquire a working knowledge of a few models representing a variety of types of instructional development. Then, as new and different models are encountered, they can be compared to those with which one is familiar. If a client brings a model to a development project, it is probably better to use it (modified if required) rather than force the client to adopt your favorite model. Another suggestion is to have available in your repertoire examples of models that can be presented with varying levels of detail. This will provide an easy introduction for uninformed clients that can later be made more detailed as development progresses. Also, when facing a range of situations, developers should be in the position of selecting an appropriate model rather than forcing the situation to fit the model. As has been noted in other contexts, "If the only tool you have is a hammer, you tend to treat everything like a nail." Developers should have a number of tools in their tool bags and use the right tool for the right job.

Looking back over trends in ID models for the last ten years in an attempt to forecast the future is probably doomed to failure. As noted earlier, there has been little substantive change in the conceptual framework of ID models that suggests any trend. While some recent models (e.g., Bergman & Moore, 1990) are focused on new delivery systems, they do not represent any new conception of the ID process. Thus, the safe forecast based on the past would be that little change is likely in the new few years. However, this author feels that we are on the threshold of major changes in several fundamental concepts related to the instructional development process. These changes will not result in discarding current concepts, but will significantly expand the range of possible approaches to developing instruction. In fact, one of the profound changes will be to move away

from the concept of education or training occurring in one environment and performance in another. In the increasingly complex and everchanging world of the next decade, information will be too abundant and too transitory to warrant formal instruction. Embedded instruction, expert systems to guide performance, microworlds, and increased emphasis on learning how to learn and apply knowledge will call for new design and development procedures very different from those depicted by our current ID models. To repeat, these new approaches will not replace existing procedures, but will become alternatives to them. For a more complete description of these new developments see Briggs, Gustafson, and Tillman (1991) and also prepare yourself for an exciting and challenging decade ahead.

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Albero-Andres, Magdalena. (1984). The use of instructional development in the television series on economic education: "Give and Take." *Instructional Science, 13* (2): 181-191 (EJ 305 622).

Describes a case study which used the Agency for Instructional Television ID model to develop a television series on economics. Findings show how the model guided the series, its advantages, and its strengths and limitations. Also identified are the discrepancies between the ideal use of instructional development and its actual application.

Andrews, Dee H. & Goodson, Ludwika A. (1980). A comparative analysis of models of instructional design. *Journal of Instructional Development, 3* (4): 2-16. (EJ 228 351).

Examines 40 models of instructional design, identifying which of 14 common tasks in model development each includes and categorizing them by origins, theoretical underpinnings, purposes and uses, and documentation. General purposes and uses of systematic instructional design models are discussed, and an explanation for the variety of models is offered.

Bonfadini, John E. (1982). A competency-based instructional matrix. *Man/Society/Technology, 41*(8): 14-15. (EJ 262 819).

Presents a model for developing competency-based instruction via a matrix containing five conceptual dimensions: area of instruction, learning units, time

allocations, levels of mastery, and objective classification.

Bonner, Jodi. (1982). Systematic lesson design for adult learners. *Journal of Instructional Development, 6* (1): 34-42. (EJ 274 764).

Presents a model for lesson design which accommodates adult learning based on the Gagne and Briggs (1979) model of instructional design. Four stages of lesson level are discussed: (1) definition of performance objectives; (2) preparing lesson designs; (3) developing or selecting materials and media; and (4) assessing student performance.

Cantor, Jeffrey A. (1986). The strategic weapon system training program. *Journal of Educational Technology Systems, 14* (3): 229-238. (EJ 334 755).

The U.S. Navy's Strategic Weapon System training program has five principal components: needs assessment/task analysis (Personnel Performance Profile); instructional design (Training Path System); instructional development (Curricula); training implementation; and personnel and training evaluation. This training model illustrates how a program constructed around an ISD model can work.

Coldeway, Annabel E. & Coldeway, Dan O. (1987). An extension of PSI through the application of instructional systems design technology. *Canadian Journal of Educational Communication, 16* (4):279-293. (EJ 362 654).

Presents a model for course development which utilizes a behavioral approach to instruction within the context of ISD. An overview of the ISD process is given, and an introductory undergraduate psychology course prepared via modifying Keller's Personalized System of Instruction (PSI) is described.

Davies, Ivor K. (1982). The CLER model in instructional development. *Viewpoints in Teaching and Learning, 58* (4): 62-69. (EJ 273 607).

H.S. Bhola's CLER (configurations, linkages, environments, resources) Model, when applied to instructional development, can anchor instructional development in

real time and space, assist in focusing the variables involved, help determine the range of choices, and assist with implementation and evaluation. It can help developers assess alternatives and choose among them.

Flouris, George. (1989). The use of an instructional design model for increasing computer effectiveness. *Educational Technology, 29* (1): 14-21. (EJ 389 240).

Presents an instructional design model for the development of software to increase the effectiveness of computer assisted instruction (CAI) in the classroom. The importance of basing the design of instructional materials on valid learning theories is discussed.

Gallini, Joan K. & Fisk, Arthur D. (1986). An information-processing approach to instructional systems design. *Educational Technology, 26* (4): 24-26. (EJ 336 231).

Proposes an instructional design model which bridges the gap between cognitive psychology and the field of instructional design.

Harmon, Paul. (1981). The conceptualization of instructional design. *Performance and Instruction, 20* (5): 20-23. (EJ 248 928).

Presents a model used to help students of instructional technology conceptualize the range of instructional designs they might utilize and which could be used to classify existing materials for easy reference.

Hooper, Simon, & Hannafin, Michael J. (1988). Learning the ROPES of instructional design: Guidelines for emerging interactive technologies. *Educational Technology, 28* (7): 14-18. (EJ 376 635).

Guidelines presented for the design of instruction using interactive technologies are based on theory and research in learning, instruction, and/or media development. Also explained is a meta-model, ROPES, which highlights retrieval of information, orienting activities, presentation, encoding in the cognitive structure, and the sequencing of lessons.

Keller, John M. (1979). Motivation and instructional design: A theoretical perspective. *Journal of Instructional Development, 2* (3): 26-34. (EJ 222 085).

Reviews research and theories in the area of motivation, and develops a model for a systematic approach to designing motivating instruction.

McCombs, Barbara L. (1986). The instructional systems development (ISD) model: A review of those factors critical to its successful implementation. *Educational Communication and Technology, 34* (2): 67-81. (EJ 349 601).

Reviews factors leading to the successful implementation of the Instructional Systems Development (ISD) Model and derives implications for the design of an ISD users training program. Military and civilian ISD models are discussed, and recommendations for further research and development are given.

Nelson, Wayne A. *et al.* (1988). The intellectual content of instructional design. *Journal of Instructional Development, 11* (1) :29-35. (EJ 380 496).

Describes instructional design as a high-level thinking process to provide more information on the way instructional design is learned and actually practiced. Topics discussed include cognitive psychology, design models, planning, schema theory, development of expertise, metacognition, problem solving, and implications for training and future research.

Noel, Kent L. & Hewlett, Brent. (1981). Plying your craft: Instructional development and the use of heuristics. *Performance and Instruction, 20* (7) : 15-18. (EJ 252 524).

Examines an ISD model used by Bell Laboratories as an illustration of how heuristics can be brought to bear upon the design and development of instructional materials.

Romiszowski, Alexander J. (1981). A new look at instructional design. Part I. Learning: Restructuring one's concepts. *British Journal of Educational Technology, 12* (1): 19-48. (EJ 247 474).

Discusses the limitations of existing instructional design models, including Gagné's, and describes a new,

more complete model meant to improve upon those now in use.

Silber, Kenneth H. (ed.). (1980). Symposium on ID models. *Journal of Instructional Development, 4* (2): 19-37. (EJ 240 864).

Presents papers on four different ID models currently in use in either a university or a business setting. All phases of systematic development are covered, including project selection, production, implementation, performance analysis, constraints, and unusual features that distinguish each model.

Taylor, Robin & Doughty, Philip L. (1988). Instructional development models: Analysis at the task and subtask levels. *Journal of Instructional Development, 11* (4): 19-28. (EJ 385 884).

Describes, justifies, and illustrates a process for analyzing and comparing ID models at the task and subtask levels. ID tasks and subtasks are identified, and various instructional design and instructional development models are compared as to both comprehensiveness and operational level.

Wileman, Ralph E. & Gambil, Thomas G. (1983). The neglected phase of instructional design. *Educational Technology, 23* (11): 25-32. (EJ 292 009).

This article discusses three phases of instructional design: (1) definition of instructional parameters; (2) analysis and synthesis of instructional alternatives; and (3) implementation of the instructional plan. Also includes a 15-step ID model, which at each step provides a descriptive name, a boxed example, and a rationale and current state of the technology for that step.

Bass, Ronald K. & Dills, Charles R. (Eds.). (1984). *Instructional development: The state of the art, II.* Dubuque, IA: Kendall Hunt Publishing Co. (ED 298 888).

Designed to serve both as a textbook and as a reference source for instructional developers who wish to keep up with develop-

ments in the field, this book presents a broad view of the field of instructional development together with in-depth descriptions of important new topics and the latest developments in the old ones.

Berkowitz, Melissa & O'Neil, Harold F., Jr. (1979). *An annotated bibliography for instructional systems development.* Alexandria, VA: Army Research Institute for the Behavioral and Social Sciences, 57pp. (ED 186 023).

This annotated bibliography lists instructional development resources relevant to the Interservice Procedures for Instructional Systems Development Model (IPISD), a standardized model providing for the assessment of training needs; the design, development, and implementation of instruction; and the assessment of instructional quality. Following a literature search, relevant documents are classified according to the 19-block IPISD Model, and summaries identify documents on authoring aids, procedures, or techniques. The purpose of each block in this model is defined, and documents are listed alphabetically within blocks. A status section for each block indicates the availability of authoring aids sufficient to guide an individual through all activities specified by the block, as well as the availability of relevant procedures and techniques that could be developed into authoring aids. Directions for future research, based on the lack of authoring aids available, are identified.

Davies, Ivor. (1984). Instructional development: Themata, archetypes, paradigms, and models. In *Instructional development: The state of the art, II.* Dubuque, IA: Kendall Hunt Publishing Co. (ED 298 890).

This chapter discusses the foundations of instructional development and analyzes the development of various models, paradigms, archetypes, and themata used to describe instructional development. Two key strands in the literature of instructional development—instructional efficiency ("doing the right things") and instructional effectiveness ("doing the things right")—are described. Objective and subjective paradigms are then considered, as well as three archetypes of instructional development: the audiovisual, engineering, and problem

solving archetypes. In conclusion, it is argued that instructional development should not be viewed as a process, but as a set of criteria to which the technologies of the field must contribute.

Dixon, Terry. (1984). *A suggested model for development of computer assisted instruction for higher education.* 19pp. (ED 250 982).

A model for the development of computer-assisted instruction (CAI) is presented for the college classroom teacher. The following common software design models that have been helpful in developing CAI models are briefly reviewed: composite or structural design model, Jackson model, META step-wise refinement model, and higher-order software model. Design principles that encourage the development of good software are also explained, i.e., modularity, abstraction, localization, and hiding. The CAI design model is based on the META step-wise refinement model and consists of five phases: problem clarification, system design, blueprinting, CAI synthesis, and documentation development. The problem clarification phase is composed of three tasks: objective development, content research, and narrative synthesis. The purpose of system design is to prepare the instruction for computer coding. Blueprinting involves the development of a detailed description of the CAI from frame to frame and function to function. This phase involves two stages of development: frame development and frame design. CAI synthesis refers to the actual encoding of the computer, along with debugging and evaluation. Finally, documentation involves the development of manuals and technical data.

Gerlach, Vernon S., & Cooper, Mary E. (1985). *A model for the development of computer instructional specifications.* 39pp. (ED 270 097).

The development of computer-based instruction will be greatly facilitated by the use of an effective and efficient design model. Five components of such a model are: (1) the objective; (2) the content; (3) the questions; (4) the boundaries; and (5) the entry skills. A good objective describes either something observable that learners do, the conditions under which they do it, and

the standard of an acceptable performance; or an observable product that learners produce, the conditions under which they produce it, and the standards of an acceptable product. The content may take many forms—definition, description, generalization, principle, rules, and others. Learner processes will vary according to the content type, i.e., a rule-using task requires the learner to state the rule and then to apply it to a previously unencountered example of the class of problems for which the rule is intended. The questions enable the student to interact with the content and they test the student's mastery of the objective. Questions may be stated in interrogative (Which one is green?) or imperative form (Write the sum of three numbers), and three kinds of feedback can be provided: knowledge of results (KR), knowledge of correct results (KCR), or KCR with advancement to next problem or question. The boundaries define the area the objective covers; one part of that area is the domain (stimulus or display), the other is the range (answers to the questions). Entry behaviors are stated for two reasons: (1) to ensure that nothing is omitted and that there are no overlaps between old knowledge and new instruction, and (2) to weed out students who lack prerequisite skills. Examples are provided for each of the five model components.

Hymel, Glenn M. (1981). *An instructional design model for guided mastery learning research and development efforts.* Paper presented at the Annual Meeting of Mid-South Educational Research Association (Lexington, KY, November 11). (ED 222 527).

Proposed is a comprehensive instructional design model which (1) suggests a systems-based approach to preparing, implementing, and evaluating instruction at the program syllabus, course syllabus, and instructional unit levels; (2) subsumes those various dimensions of a mastery learning strategy which encompass preconditions, operating procedures, and anticipated consequence; (3) relates the generic activities of instructional design to those essential elements comprising a mastery learning strategy; (4) provides a broad-based context for interpreting completed and on-going research and development efforts in mastery learning;

and (5) represents a multidimensional framework for guiding future basic and applied research as well as the subsequent development efforts in mastery learning. Areas of congruence between generic activities in instructional design and essential components in a mastery learning strategy, as well as additional activities mandated by any comprehensive instructional design effort, have provided the basis for identifying possible variables of an independent, moderator, dependent, and intervening nature that might be considered in future mastery learning research and development endeavors.

Keller, John M. (1983). *Use of the ARCS model of motivation in teacher training. IDD&E working paper no. 10.* Syracuse, NY: Syracuse University, School of Education, 11pp. (ED 288 520).

This paper presents the ARCS model, which is a research-based systematic design model that interfaces with typical instructional design and development models to improve the motivational appeal of instructional materials, of instructor behavior, and of the way in which lessons (or modules) and courses are designed. The description of the model, which provides strategies that a course designer or teacher can use to make instruction responsive to the interests and needs of learners, includes: (1) four major conditions defined by the model that have to be met for people to become and remain motivated, i.e., Attention, Relevance, Confidence, and Satisfaction (ARCS); and (2) the three phases of using the model in an instructional development sequence, i.e., define, develop, and evaluate. The paper concludes with a discussion of two developmental tests of the ARCS model, which involved its presentation at teacher training workshops and evaluation of the results of the participants' subsequent applications of the model in their classrooms.

Montague, William E. & Wulfeck, Wallace H., II. (1982). *Improving the quality of navy training: The role of R&D in support of instructional systems design. Final report.* San Diego, CA: Navy Personnel Research and Development Center, 25pp. (ED 243 472).

This report reviews the background of the ISD model (used to develop training for Naval personnel), identifies problems in the ISD process and in its management and implementation, and recommends methods of ISD improvement. The ISD model is described as a process originally developed to remind instructional development experts about steps needed to produce quality instruction, but subsequently implemented to help content specialists (who are relatively inexperienced in instructional design and development) build instruction. It is noted that ISD methods as used by nonexperts are not successful because they lack detailed procedural guidance. Instructional engineering and management problems in implementing ISD are outlined and three alternative solutions to these problems are considered and rejected. Several recent research efforts are then summarized, including the instructional quality inventory (IQI), which provides quality assurance methods for the ISD; the development of guidelines for building more relevant criterion referenced tests; and the initial development of computer assisted training development. It is recommended that the Naval Education and Training Command (NAVEDTRACOM) develop: (1) systematic methods for monitoring ISD implementation and the performance of ISD practitioners and managers; (2) training and professional development programs for these persons; and (3) automated aids for ISD. A 36-item bibliography and a report distribution list are provided.

Reigeluth, Charles M. & Schwartz, Ellen. (1987). *An instructional theory for the design of computer-based simulations. IDD&E working paper no.* 23. Syracuse, NY: Syracuse University, School of Education, 26pp. (ED 289 470).

A simulation is described in terms of its three major aspects: the scenario, the underlying model, and the instructional overlay. The major focus of this paper is the instructional overlay as the component that serves to optimize learning and motivation. Functions of simulations are identified as the acquisition of content, the application of the content, and the assessment of learning. Five simulation features that act as vehicles for achieving these functions are then discussed:

generality, example, practice, feedback, and help. A general model for the design of computer-based simulations is presented which offers prescriptions for the design of the introduction, acquisition, application, and assessment stages of simulations, and for dealing with the issue of control (system or learner). Variations on the general model are then presented which are based on the nature of the behavior (procedures, process principles, and causal principles); complexity of the content; form of learner participation; form of changes (physical or non-physical); and motivational requirements. In conclusion, it is noted that these prescriptions are only a first step in an attempt to construct a validated prescriptive theory for the design of computer simulations, and that considerable research and extensive field tests are needed to provide the information necessary for both confirmation and revision of the various aspects of the theory.

Smith, Patricia L. (1985). *Supplantation versus generative models: Implications for designers of instructional text*. Paper presented at the Annual Convention of the Association for Educational Communications and Technology (Anaheim, CA, January 17-23). (ED 256 338).

Two instructional design alternatives are described and discussed: (1) the supplantation model of Ausburn and Ausburn (1978), where learning strategies are built into the instructional materials; and (2) a generative design model, where strategies are "built" into the learner. These contrasting models are proposed as representing the extremes of a continuum that illustrates the ratio of the amount of processing support provided by the instruction to the amount of cognitive elaboration required of the learner. The relative advantages and disadvantages of each model are examined, and a line of research is suggested for investigating the conditions under which each model, or compromises between the two models, might be appropriate. This discussion is related to current philosophical questions in the field of instructional design. Examples are used from the design of instructional print.

Stumpf, Mark R. (1987). *An instructional design model for developing a computer curriculum to increase employee productivity in a pharmaceutical company*. Ed.D. practicum, Nova University, Florida. (ED 294 565).

This report presents an ID model that was developed for use by the End-Users Computing department of a large pharmaceutical company to develop effective, but not lengthy, microcomputer training seminars to train office workers and executives in the proper use of computers and thus increase their productivity. The fourteen steps of the ID model are described, and appendices include an instructional design model flowchart; sample lesson modules; instructor, observer, and student evaluation forms; and a course module design checklist.

Sullivan, Robert Francis. (1982). *Toward an integrative open-systems model of instructional development in educational and non-educational organizations*. Ph.D. Dissertation, State University of New York at Buffalo. (ED 248 879).

The open-systems model of instructional development (ID) proposed for use in both educational and non-educational organizations is based on an extensive examination of ID, the systems and communication/consulting literature, and the results of a nationwide survey of 750 currently active ID professionals in both higher education and business/industry regarding ID process behaviors. The survey focused on 26 behaviors that may be practiced in the process of developing instruction. Respondents indicated the percentage of time they currently practice each behavior and the percentage of time they feel each behavior should be practiced under "ideal circumstances." Analysis of the 411 usable surveys received (69%) revealed that, while there are isolated differences between education and business respondents, both subgroups follow the same basic ID process, and respondents as a group believe that all 26 ID process behaviors should be practiced significantly more often than they currently are. Further research into the ID process is suggested, including field testing and validation of the proposed ID model. A 22-page bibliography and reference list, a glossary, the survey instrument, survey cover and follow up letters, and correlation matrices are included.

Tessmer, Martin & Jonassen, David H. (1988). A CBI model for the design of CAI software by teachers/non-progamers. In *Proceedings of selected research papers presented as the annual meeting of the Association for Educational Communications and Technology (New Orleans, Louisiana, January 14-19).* (ED 295 668).

This paper describes a design model presented in workbook form which is intended to facilitate CAI software design by teachers who have no programing experience. The seven-part instructional program used to teach the CAI model includes: (1) determination of the objective of the lesson; (2) a task analysis of the lesson; (3) classifications of the learning outcomes of the lesson; (4) design of the readiness for learning strategy; (5) design of the CAI instructional component; (6) conversion of workbook program design into screen displays; and (7) a formative evaluation of the lesson via screen displays.

Trimby, Madeline J. & Gentry, Castelle G. (1984). State of ID systems approach models. In *Instructional development: The state of the art, II.* Dubuque, IA: Kendall Hunt Publishing Co. (ED 298 896).

This chapter presents and analyzes current developments in the evolution of the instructional systems development model. First, basic definitions of general systems and instructional development model terms are provided, and the differing uses of the terms "instructional development," "instructional technology," and "educational technology" are considered. The idea of a model and four different ways in which to use this term are then discussed, as well as current and classic instructional development models. These instructional development models are analyzed and compared, and criteria for selecting a model for use in a specific project are given. Finally, a process for developing instructional development models is outlined, and areas of needed research are detailed.

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